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NATIONAL BUREAU OF STANDARDS REPORT

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Fourth

Progress Report

on the
Mechanisms of Fire Ignition and Extinguishment

by
E. C. Creitz

Covering period 1 January to 30 June 1958

for

Bureau of Ships
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4. DISPERSIBILITY OF DRY POWDERS

The dispersibility of eleven commercially available dry powders was measured using the method described in NBS Report No. 5424 and quite a wide range of dispersibility found. No information is available to date on the relation between dispersibility of a powder and its efficiency in the extinguishment of fires, although it appears, intuitively, that there should be some connection.

5. SOLID PROPELLANTS

Kinetic and thermal data have been obtained on two solid propellants and estimates made of the maximum pile size and surface temperature which would be permitted during storage. These investigations are reported in NBS Report No. 5851, by A. F. Robertson and J. Loftus, "Self-Ignition Properties of Two Propellant Types."

6. THERMAL REACTIONS

A rather extensive literature survey has been made on the basic reactions taking place during combustion in an attempt to gain some insight into the mechanism of extinguishment. Since both halide type extinguishing agents and dry chemical powders appear to act through ionic processes, attention has been focused on ionic reactions in flames. A program has been outlined which will involve identification of ions and measurement of their concentrations in both normal and inhibited flames. Since the scope of this investigation is likely to be outside the immediate field of interest of this project, it will be financed largely from NBS funds.

MECHANISMS OF FIRE IGNITION AND EXTINGUISHMENT

1. SUMMARY

Studies of the mechanisms of fire ignition and extinguishment have been made and are continuing with emphasis on the mechanisms of extinguishment. Work was completed on the vertical combustion tube and the results reported as indicated below. The results obtained in using dry chemical extinguishing agents on liquid fires in 1-in. cups are being compared to similar fires in 6-in. cups and will be extended to 10-in. and larger cups in an attempt to determine scaling factors. The dispersibility of dry powders continues to be of interest although the connection between the dispersibility of the powder and its efficiency as an extinguishing agent is yet to be determined. Some properties of two types of solid propellants have been measured and related to conditions of storage. Because there is some evidence that the action of both halide and dry powder extinguishing agents is connected with ionic and other electrical properties of the materials, work has been started on the identification of ions in normal and inhibited flames.

2. VERTICAL COMBUSTION TUBE

Measurements have been made on the quenching efficiency of a 100 mesh stainless steel screen coated with thin layers of potassium bicarbonate, potassium oxalate monohydrate and rubidium iodide as well as with the bare screen. Quenching depended on the flame front velocity and could be explained by thermal considerations alone. The results are contained in NBS Report No. 5790, by T. G. Lee, "A Technique for Study of Flame Quenching Properties of Salts."

3. POWDER APPLICATION

A device for application of dry chemical extinguishing agents has been improved and applied to liquid fires in 6-in. cups. Preliminary results indicate that efficiencies similar to those previously obtained on fires in 1-in. cups are to be expected. The work is being extended to 10-in. cups and larger, in order to obtain scaling factors so that laboratory tests may be related to actual fires. The experimental details of the device for application of the powders is covered in NBS Report No. 5972 by A. F. Robertson and T. G. Lee, "A Method for Application of Powders to Test Fires."